

Deliverable Discussion- Product #3 Middle Peninsula Dunes Special Project

Product #3 was predicated on the Virginia Dunes and Beach Act being amended by the Virginia General Assembly during the Calendar year 2006 session. The Act was not amended. However, after consultation with staff from the Virginia Coastal Zone Management program, it was determined that there was still an opportunity to discuss the Dunes and Beach Act with both impacted localities and possible expansion localities.

The Middle Peninsula Coastal Technical Assistance program convenes monthly meetings of local planners and county administrators to discuss Community development and Coastal Zone management issues. During the September 2006 meeting of the local planners group, C. Scott Hardaway, Jr. Coastal Geologist VIMS presented a learning seminar for local staff on the Dunes and Beach Act. Six jurisdictions were represented at the meeting.

C. Scott Hardaway, Jr. Coastal Geologist VIMS discussed and answered question related to the primary and secondary dunes system within the Chesapeake Bay, pro's and cons of expanding the dunes act, establishment of a metric to help plan for the protection of dunes and how dunes can be used as a mitigation strategy for hazard mitigation.

Those in attendance expressed an improved understanding of the importance of dunes and beach act and the functional utility of beaches and dunes.

Sand Dunes of the Chesapeake

C. Scott Hardaway, Jr.
Coastal Geologist

VIMS

Chesapeake Bay Dunes: Evolution and Status

Scott Hardaway, Lyle Varnell, Donna Milligan, George Thomas, and Woody Hobbs

Virginia Institute of Marine Science, College of William & Mary



Study Purpose

The purposes of this multi-year research project were to:

- Locate, classify, and enumerate the existing jurisdictional dunes and dune fields within the 8 Bay localities identified in the Coastal Primary Sand Dune Protection Act (1980) and those localities excluded from the Act but containing dunes.
- Develop dune inventories for localities in the Act.
- Detail morphologic and shoreline change at dune sites.
- Establish a dune monitoring project to analyze beach and dune change in detail in particular regard to the relationship between primary and secondary dunes and dune system effects on ground water.

The Dune Act



Jurisdictional Localities

- Accomack Co.
- City of Hampton
- Lancaster Co.
- Mathews Co.
- City of Norfolk
- Northampton Co.
- Northumberland Co.
- City of Virginia Beach

Non-Jurisdictional

Westmoreland, Middlesex, York, City of Newport News, Surry, Isle of Wight, Suffolk, Portsmouth

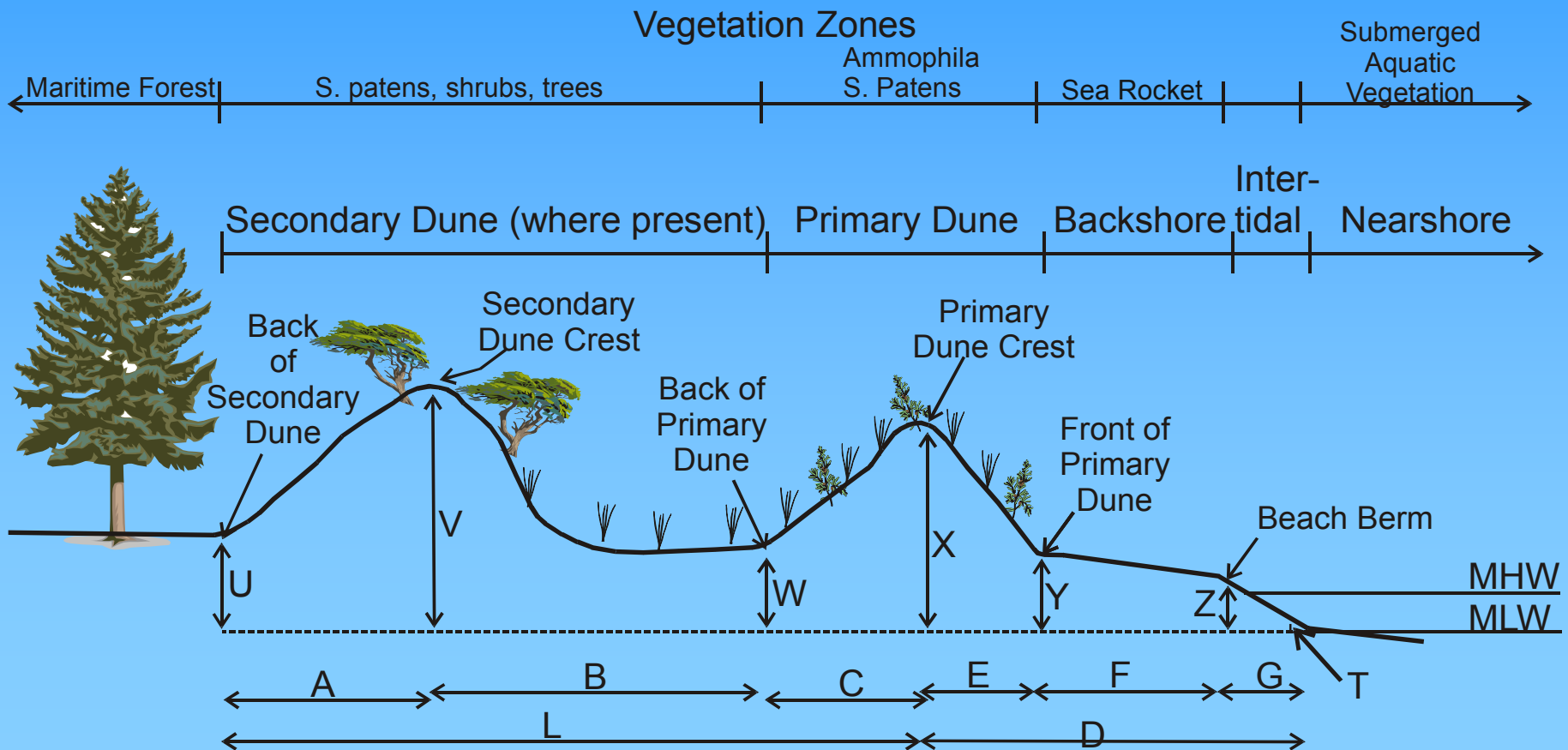
The Dune Act

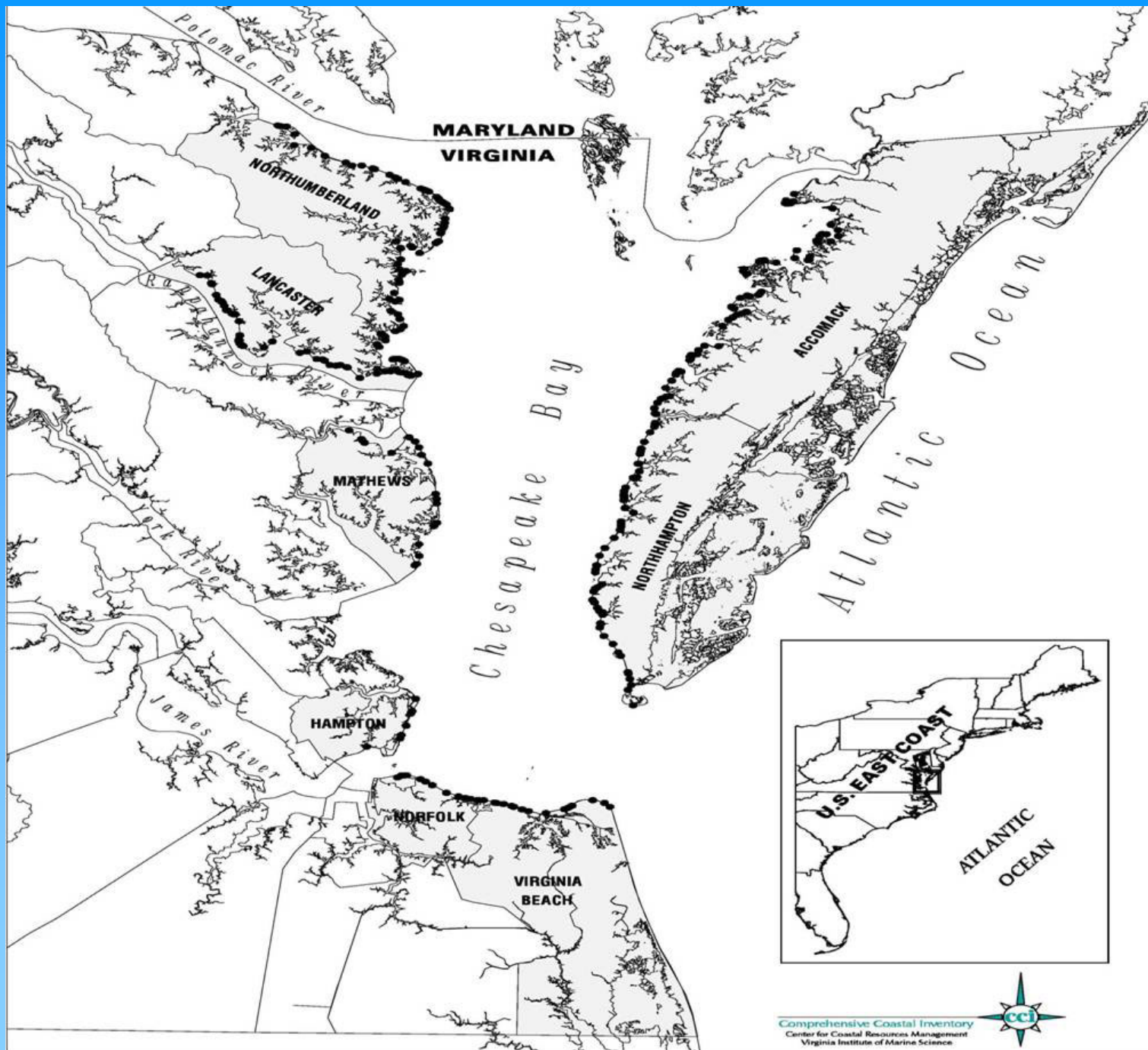
According to the Dune Act, a dune is defined by three variables:

- **Substance** (a mound of unconsolidated sand soil contiguous to MHW)
- **Morphology** (landward and lateral limits are marked by a change in grade)
- **Character** (dunes must support specific plant species or communities)

Dune Definitions

Chesapeake Bay Dune Profile





Dune Spatial Distribution

Table 6. Number and length of potential and identified dune sites by locality.

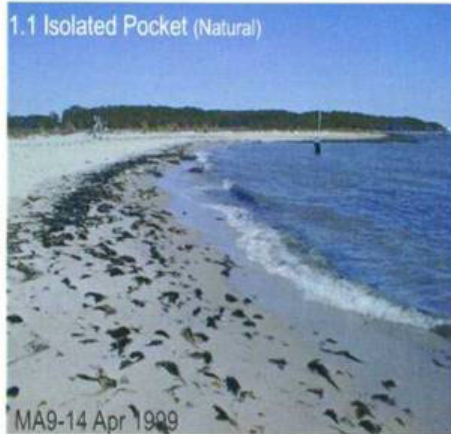
Locality	Potential Dune Sites		Dune Sites Visited		Percent Dune Site Length Visited	Jurisdictional Dune Sites	
	Number	Total Length (feet)	Number	Total Length (feet)		Number	Total Length (feet)
Accomack	72	36,640	26	23,040	63%	24	22,340
Lancaster	76	26,735	50	16,275	61%	44	15,260
Mathews	25	20,510	23	19,730	96%	21	19,350
Northampton	66	65,665	50	56,624	86%	42	54,114
Northumberland	87	40,790	80	36,900	90%	61	33,240
Hampton	14	14,310	12	12,760	89%	7	10,540
Norfolk	13	25,600	9	23,860	93%	9	23,860
Virginia Beach	23	41,330	11	30,290	73%	11	30,290
Total	376	271,580	261	219,479	81%	219	208,994

Table 7. Jurisdictional primary and secondary dune number of sites and length.

Locality	Total No. Sites	Total Site Length (ft)	Primary Dune Only				Primary/Secondary Dune Sites			
			No. Sites	Total Length (ft)	Total Length (%)	Avg. Site Length (ft)	No. Sites	Total Length (ft)	Total Length (%)	Avg. Site Length (ft)
Accomack	24	22,340	16	13,420	60%	839	8	8,920	40%	1,115
Lancaster	44	15,260	38	11,400	75%	300	6	3,860	25%	643
Mathews	21	19,350	16	6,810	35%	426	5	12,540	65%	2,508
Northampton	42	54,114	28	30,484	56%	1,089	14	23,630	44%	1,688
Northumberland	61	33,240	55	22,640	68%	411	6	10,600	32%	1,767
Hampton	7	10,540	4	4,250	40%	1,063	3	6,290	60%	2,097
Norfolk	9	23,860	4	9,740	41%	2,435	5	14,120	59%	2,824
Virginia Beach	11	30,290	4	8,510	28%	2,128	7	21,780	72%	3,111
Total	219	208,994	165	107,254	51%	650*	54	101,740	49%	1,884*

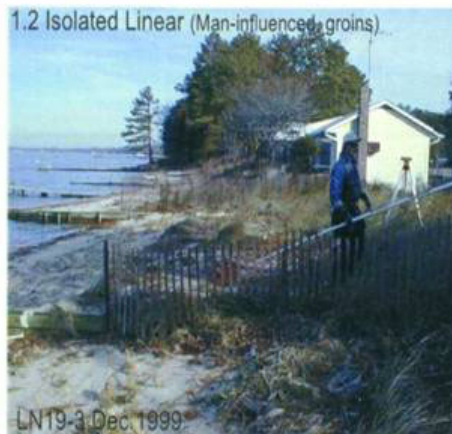
*average site length mean-weighted by number of sites

1.1 Isolated Pocket (Natural)



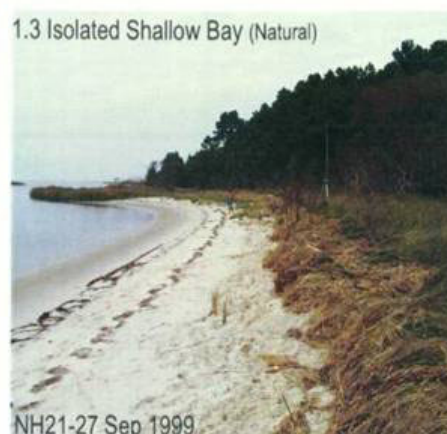
MA9-14 Apr 1999

1.2 Isolated Linear (Man-influenced, groins)



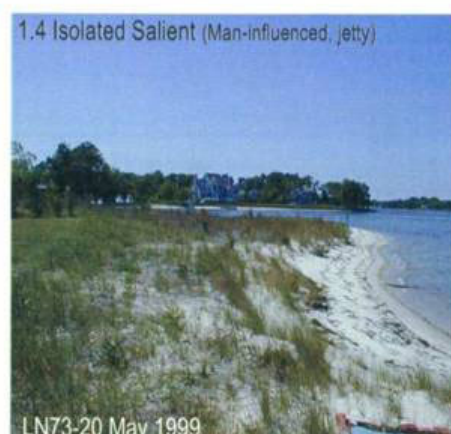
LN19-3 Dec 1999

1.3 Isolated Shallow Bay (Natural)



NH21-27 Sep 1999

1.4 Isolated Salient (Man-influenced, jetty)



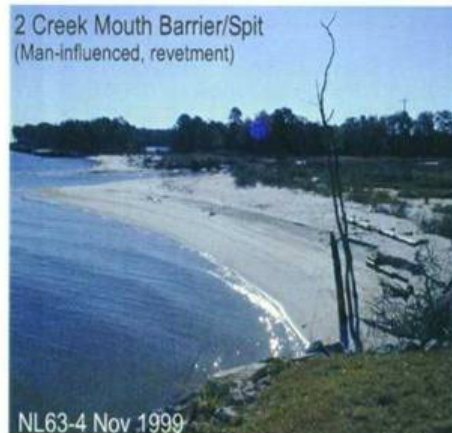
LN73-20 May 1999

2 Creek Mouth Barrier/Spit
(Natural)



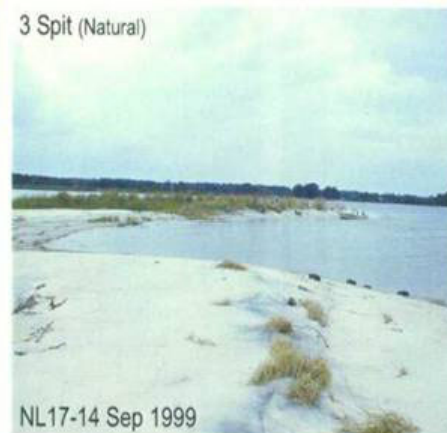
AC69-28 Sep 1999

2 Creek Mouth Barrier/Spit
(Man-influenced, revetment)



NL63-4 Nov 1999

3 Spit (Natural)



NL17-14 Sep 1999

3 Spit (Man-influenced, groin out of picture)



NH35-21 Sep 1999

4.1 Dune Field Pocket (Man-influenced, groins)



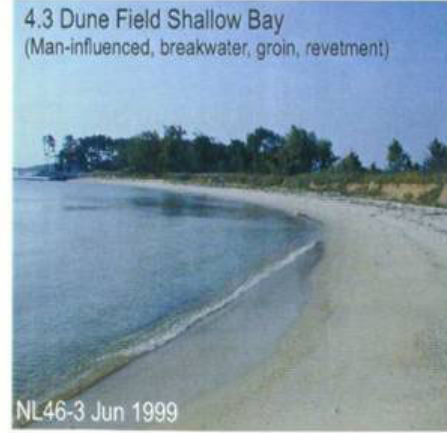
HP4-22 Sep 2000

4.2 Dune Field Linear (Man-influenced, beach fill)



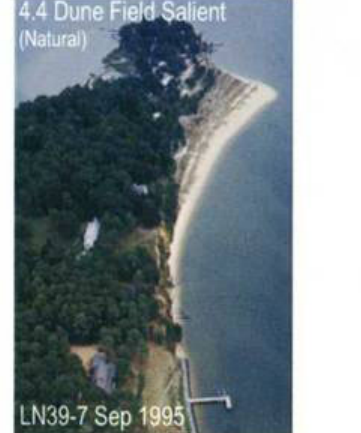
VB9-16 Aug 2000

4.3 Dune Field Shallow Bay
(Man-influenced, breakwater, groin, revetment)



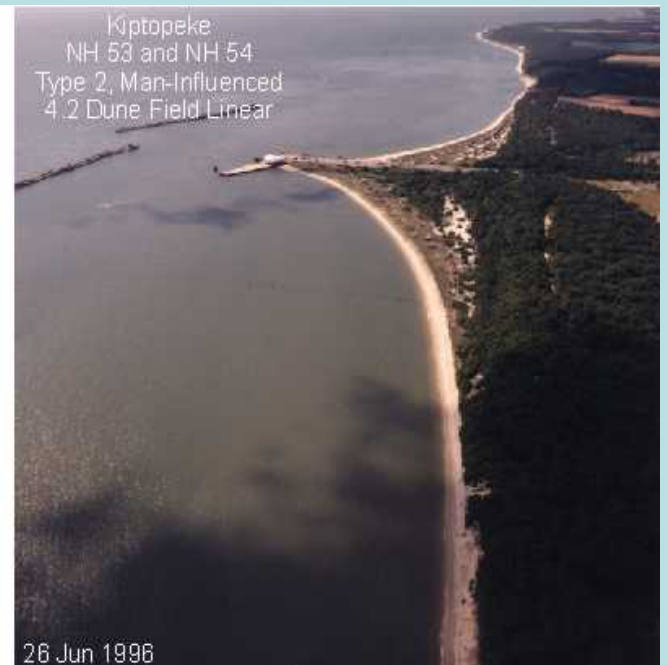
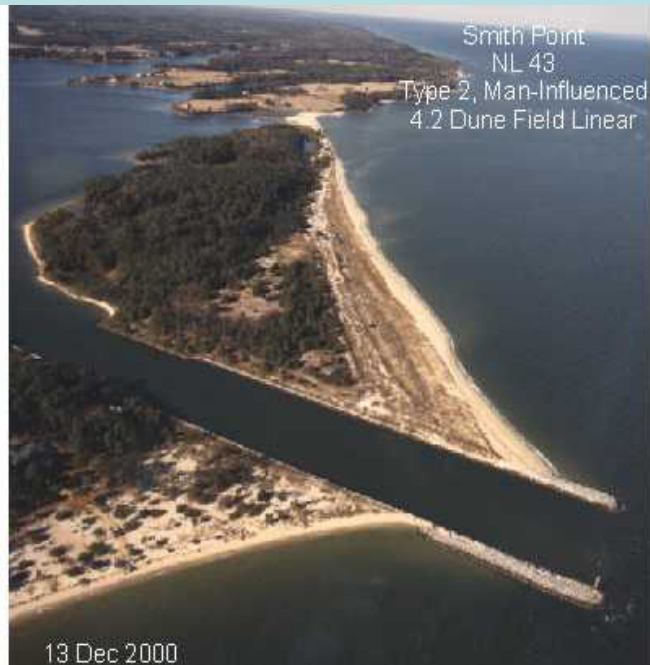
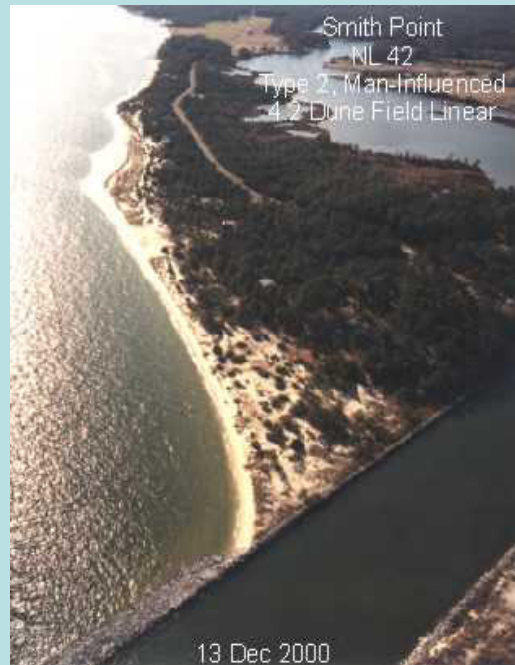
NL46-3 Jun 1999

4.4 Dune Field Salient
(Natural)



LN39-7 Sep 1995

Classification: Morphology



Classification: Results

Table 8. Percentage of natural, man-influenced and man-made dune sites by locality.

Locality	No. Sites	Total Dune Length (ft)	Percent of Total Length		
			Natural	Man-Influenced	Man-Made
Accomack	24	22,340	100%	0%	0%
Lancaster	44	15,260	46%	54%	0%
Mathews	21	19,350	58%	42%	0%
Northampton	42	54,114	65%	32%	3%
Northumberland	61	33,240	40%	60%	0%
Hampton	7	10,540	40%	60%	0%
Norfolk	9	23,860	0%	89%	11%
Virginia Beach	11	30,290	64%	36%	0%
Total	219	208,994	54%	44%	2%

Classification: Results

Table 9B. Morphologic Setting categorization by locality.

Locality	No.*1 Sites	Total *2 Length	Avg.*3	Std.*4 Dev.	Morphologic Setting															
					Isolated				Creek Mouth				Spit				Dune Field			
					No.	T.L.	Avg.	S.D.	No.	T.L.	Avg.	S.D.	No.	T.L.	Avg.	S.D.	No.	T.L.	Avg.	S.D.
Accomack	24	22,340	931	853	7	2,010	287	95	3	1,440	480	139	0	0			14	18,890	1,349	906
Lancaster	44	15,260	347	293	27	6,250	231	144	9	2,675	297	344	0	0			8	6,335	792	185
Mathew	21	19,350	926	1,166	12	3,700	308	154	4	8,090	2,023	1,336	0	0			5	7,560	1,512	1,618
Northhampton	42	54,114	1,288	1,211	11	3,835	349	102	8	3,177	397	344	6	7,410	1,235	486	17	39,692	2,335	1,208
Northumberland	61	33,240	545	643	23	6,190	269	126	18	7,150	397	235	10	3,390	339	188	10	16,510	1,651	965
Hampton	7	10,540	1,506	1,368	1	220			0	0			0	0			6	10,320	1,720	1,364
Norfolk	9	23,860	2,651	2,084	1	250			0	0			0	0			8	23,610	2,951	2,010
Virginia Beach	11	30,290	2,754	2,390	1	1,020			0	0			0	0			10	29,270	2,927	2,445
Total	219	208,994			83	23,475			42	22,532			16	10,800			78	152,187		
Percent					11%				11%				5%				73%			

County	Morphologic Setting *5			
	Isolated	Ck Mouth	Spit	Field
Accomack	9%	6%	0%	85%
Lancaster	41%	18%	0%	42%
Mathew	19%	42%	0%	39%
Northhampton	7%	6%	14%	73%
Northumberland	19%	22%	10%	50%
Hampton	2%	0%	0%	98%
Norfolk	1%	0%	0%	99%
Virginia Beach	3%	0%	0%	97%

*1. Number of sites (No.)

*2. Total dune environment length in feet (T.L.)

*3. Average individual dune site length in feet (Avg.)

*4. Standard deviation in feet (S.D.)

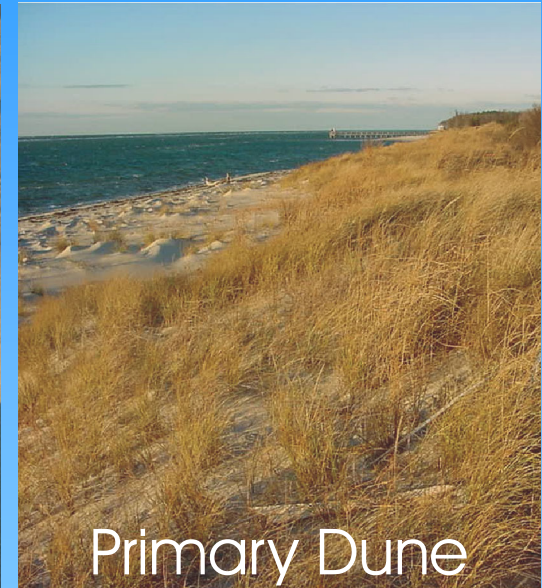
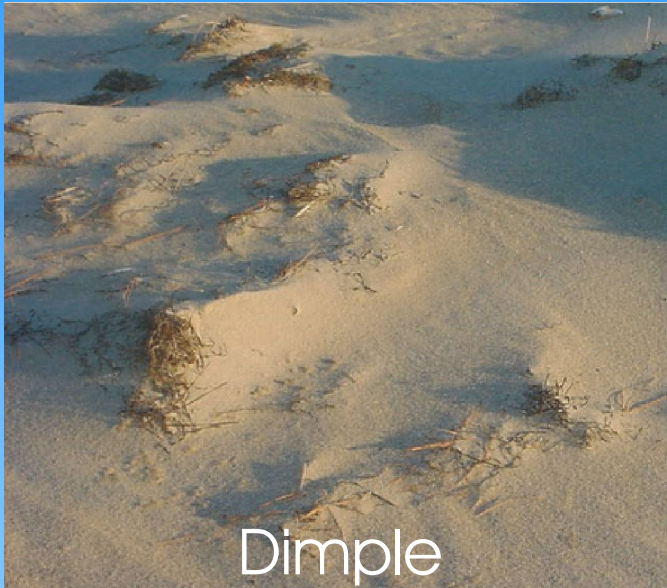
*5. Percent of total length

Bay Dune Growth Components

Primary dune growth will occur when these three components are present at a site:

- Relatively stable setting
- Abundance of sand in the littoral/shore system
- Onshore wind field climate

Dune Accretion



Accreting Dunes



Eroding Dune



Transitional Dune



Both Eroding and Accreting



Recovering Dunes



The Dune Act



Jurisdictional Localities

- Accomack Co.
- City of Hampton
- Lancaster Co.
- Mathews Co.
- City of Norfolk
- Northampton Co.
- Northumberland Co.
- City of Virginia Beach

Non-Jurisdictional

Westmoreland, Middlesex, York, City of Newport News, Surry, Isle of Wight, Suffolk, Portsmouth

Non-jurisdictional Localities

Locality	Sites
Middlesex	15
Westmoreland	12
Isle of Wight	5
Surry	0
York	3
Newport News	1
Suffolk	0
Poquoson	1



Conclusions/Recommendations

- **Amend the legal definition of a dune**

Requires Legislative Changes

- **Expand the jurisdiction of the Act**

Requires Legislative Changes

- **Establish RPA landward of dunes/beaches**

Requires implementation changes by localities

- **Emphasize dune and beach restoration/creation for erosion control**

Requires broad education effort

- **Consider adopting mitigation guidelines for dune/beach impacts**

Requires no legislative or regulatory changes

- **Establish a comprehensive dune/beach monitoring program**

Requires long-term funding commitments



Mathews County Dune Inventory

**Virginia Institute of Marine Science
College of William & Mary
Gloucester Point, Virginia**

April 2003

Chesapeake Bay

Plate 1A

Mathews County

Dyer Creek

New Point Comfort

Deep Creek

Chesapeake Bay

Plate 1B

Horn Harbor

Dyer Creek

● Dune Site

Photo base 1994
Digital Orthophoto
Quarter Quadrangles

Scale
1000 0 1000 Feet

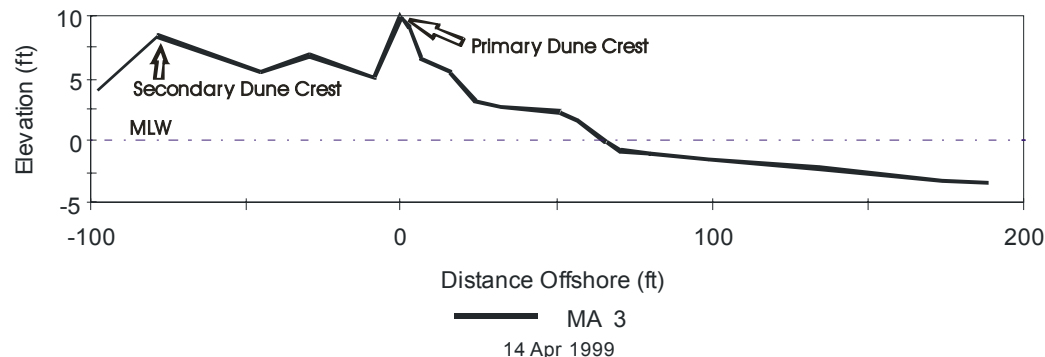


Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science



MATHEWS COUNTY DUNE SITE 3

Dune Project, Mathews



Site Information

1. Date Visited: 14 Apr 1999
2. Central Coordinates: N: 368,050 ft
E: 2,647,500 ft
3. Profile Coordinates: N: 368,050 ft
E: 2,647,500 ft
- Virginia South State Plane Grid NAD 1927 [4502]
4. Site Length: 4290 ft
5. Ownership: Private

Plate 1A

Site Parameters

6. Type: Man Influenced
7. Fetch Exposure: Open Bay
8. Shoreline Direction of Face: East
9. Nearshore Gradient: > 3,000 ft./Extensive Bars
10. Morphologic Setting: Dune Field > 500 ft. Alongshore/Linear
11. Relative Stability: Stable
12. Underlying Substrate: Upland
13. Structure or Fill: N/A

Site Measurements

- Primary Dune:**
14. Crest Elevation (ft MLW): 10.0
 15. Extent from Crest Landward (ft): 8.5
 16. Extent from Crest To MLW (ft.): 65
- Secondary Dune:**
17. Crest Elevation (ft MLW): 8.4
 18. Land Extent From Primary Crest (ft.): 98
 19. Second Crest – Landward (ft.): 20

Vegetation Communities

20. Primary Dune: *Ammophilla breviligulata*
(American beach grass)
Spartine patens (saltmeadow hay)
21. Secondary Dune: Mixed herbaceous/shrub

22. Remarks:

MA 3 is an extensive dune field that fronts the cottage communities of Bayon and Chesapeake Shores. A breakwater/sill system at the north end has prevented beach sand losses. Overall, the site is relatively stable except for a "hot spot" about midway in the reach. A secondary dune exists along much of this site.



Looking north. Note the recent advance of foredune.

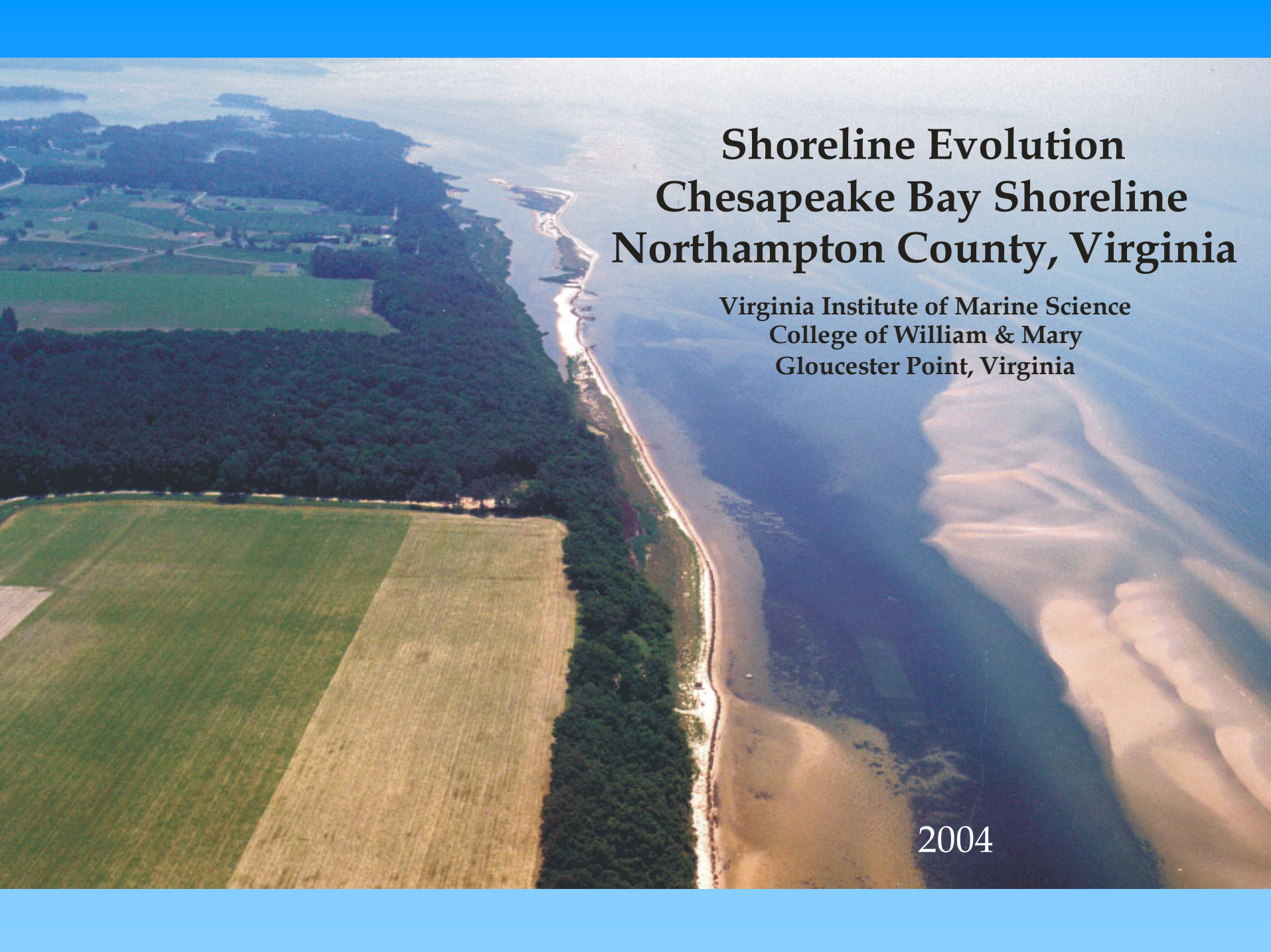


Looking northward at the "hot spot", by the yellow house. The surveyed transect is on the north side of the house.



Looking south along the primary dune crest at MA 3.

Not intended for use in determining legal jurisdictional limits



Shoreline Evolution Chesapeake Bay Shoreline Northampton County, Virginia

Virginia Institute of Marine Science
College of William & Mary
Gloucester Point, Virginia

2004

Northampton County

Plate 12

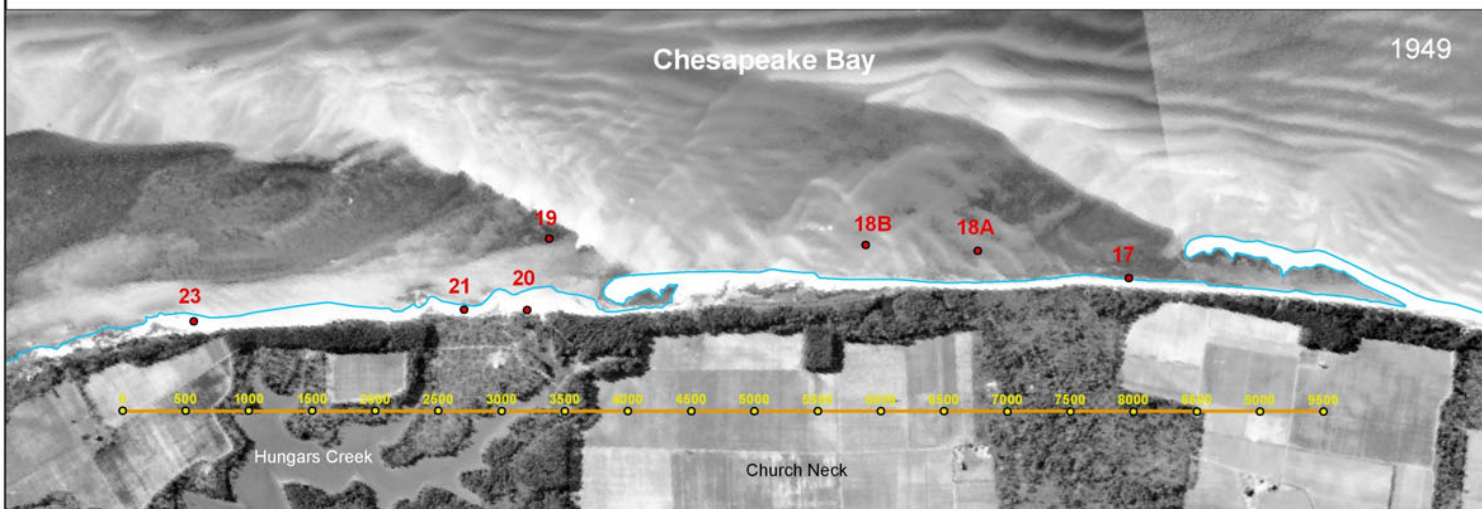
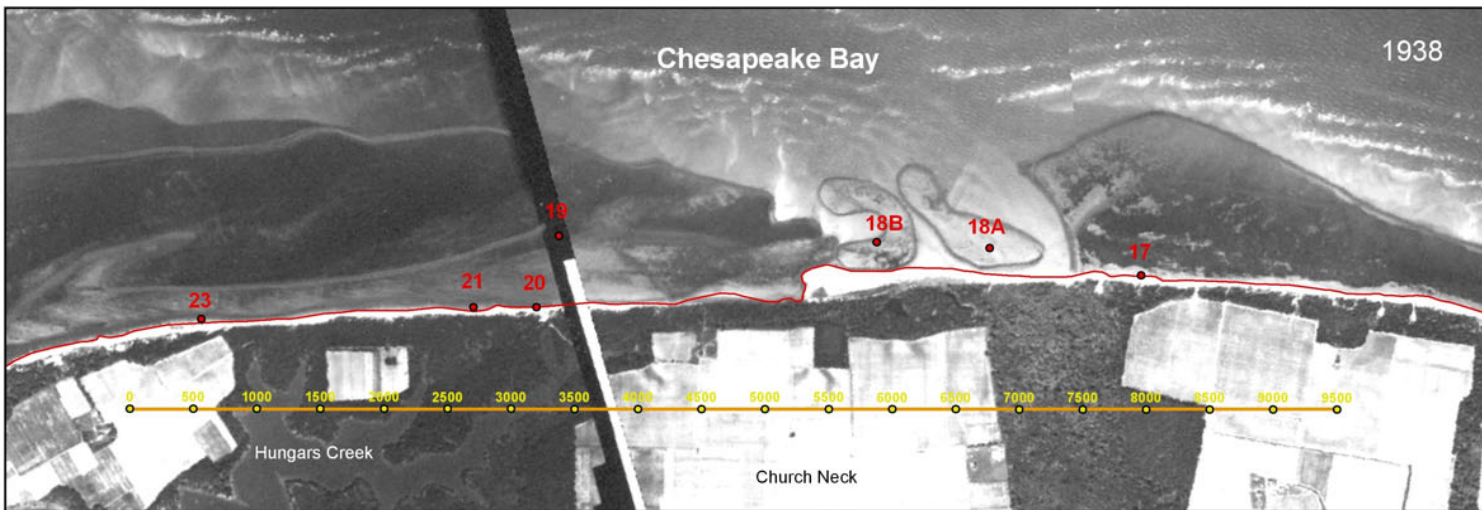
Morphologic Reach IV
Church Neck

Legend

- Identified Dune Sites
- Transect Points
- Baseline
- 1949 Shoreline
- 1938 Shoreline



1,000 0 1,000 Feet



Northampton County

Plate 12
Morphologic Reach IV
Church Neck

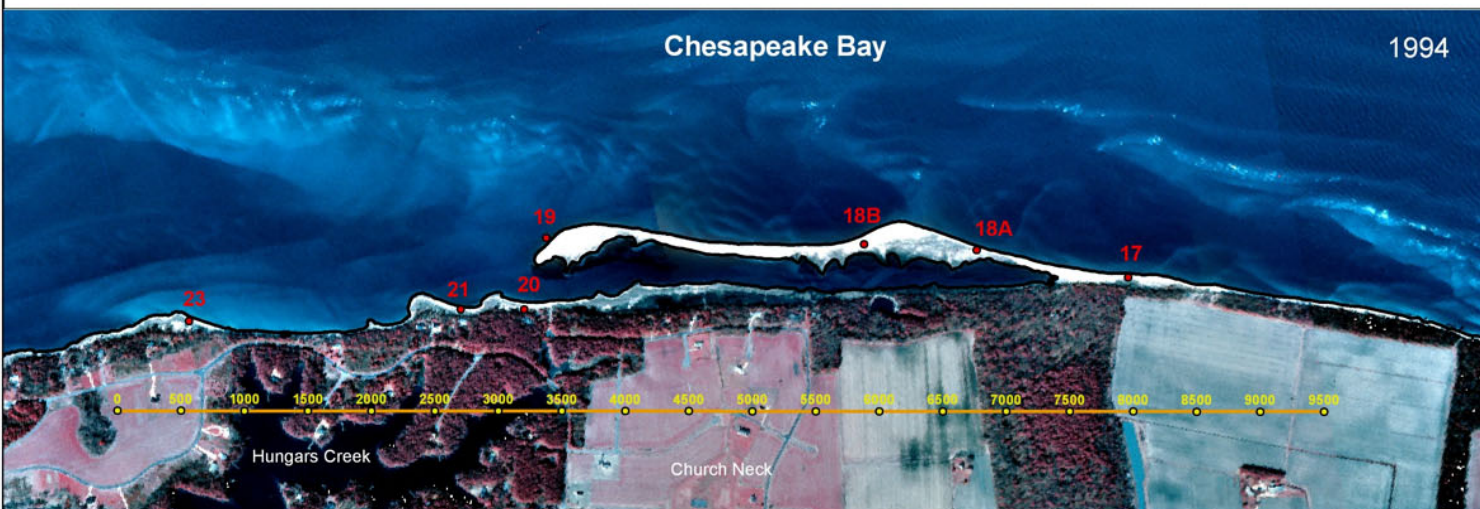
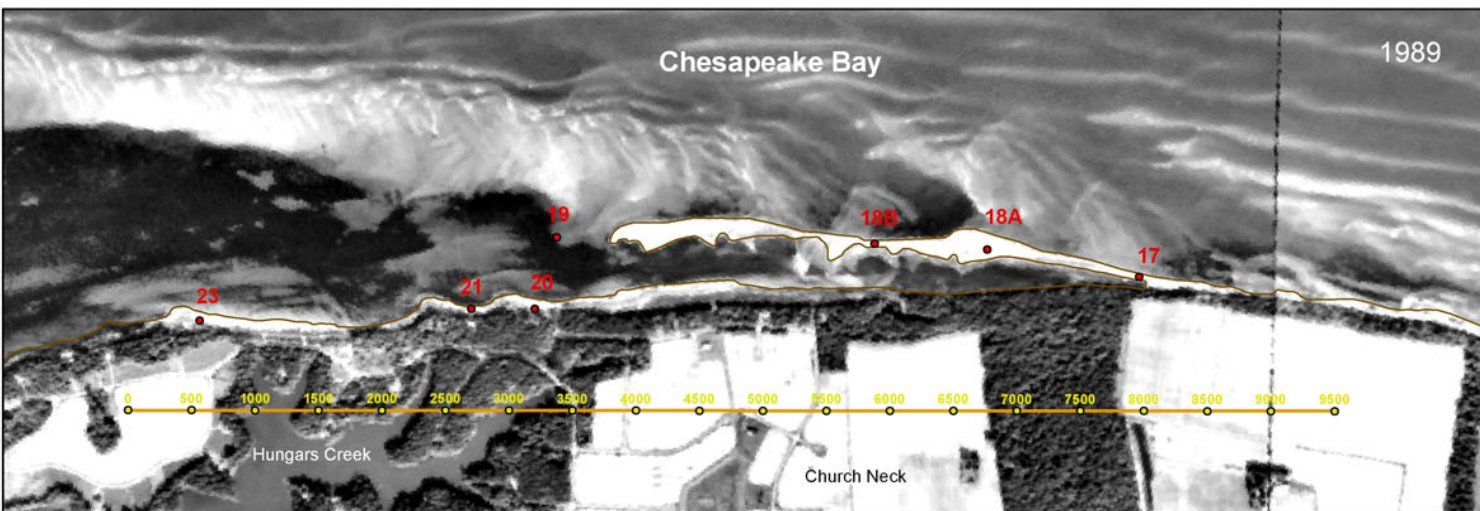
Legend

- Identified Dune Sites
- Transect Points
- Baseline
- 1994 Shoreline
- 1989 Shoreline



1,000 0 1,000 Feet

A scale bar with markings for 1,000, 0, and 1,000 feet.



Northampton County

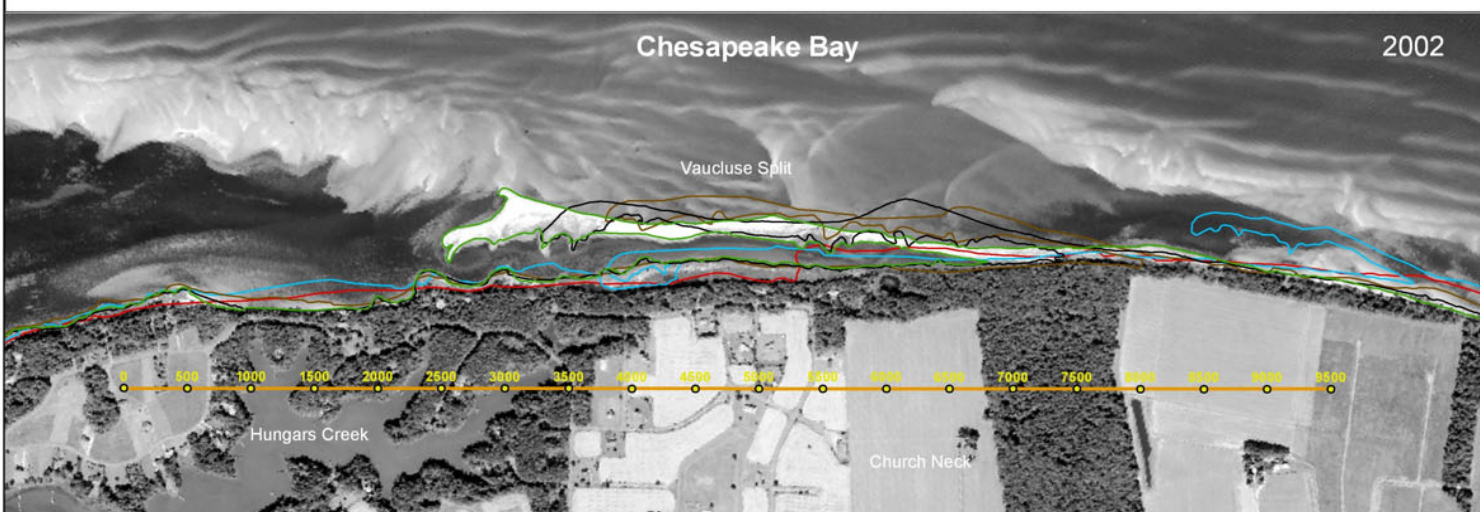
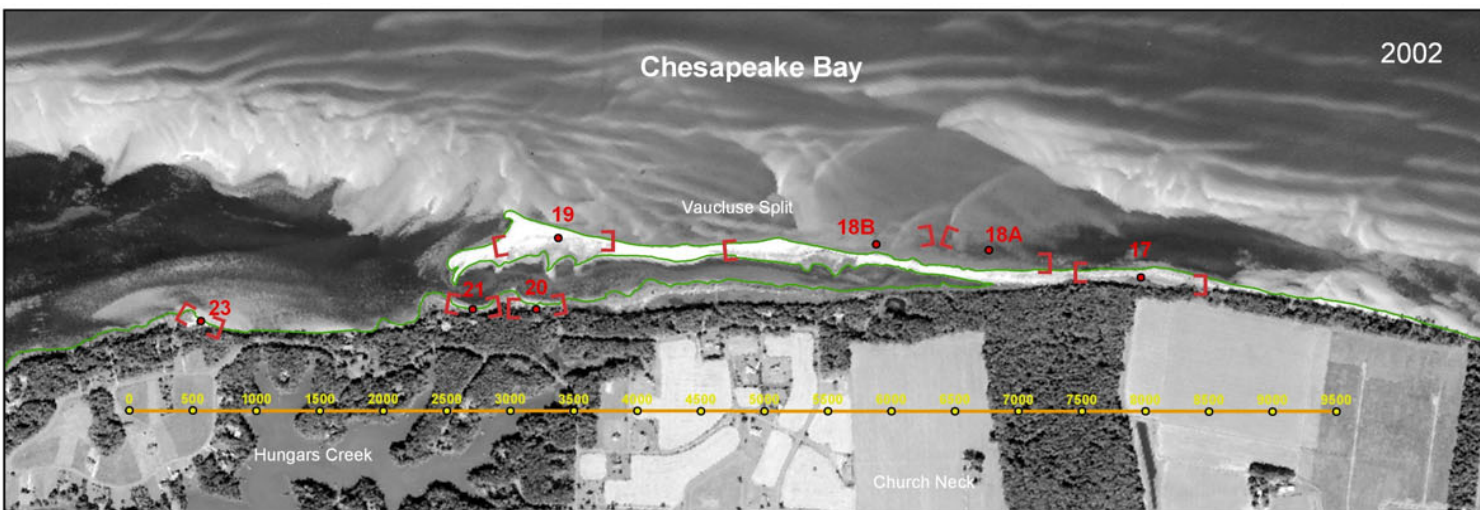
Plate 12
Morphologic Reach IV
Church Neck

Legend

- Identified Dune Sites
- Transect Points
- [] Dune Site Limits
- Baseline
- 2002 Shoreline
- 1994 Shoreline
- 1989 Shoreline
- 1949 Shoreline
- 1938 Shoreline



1,000 0 1,000 Feet



Northampton County

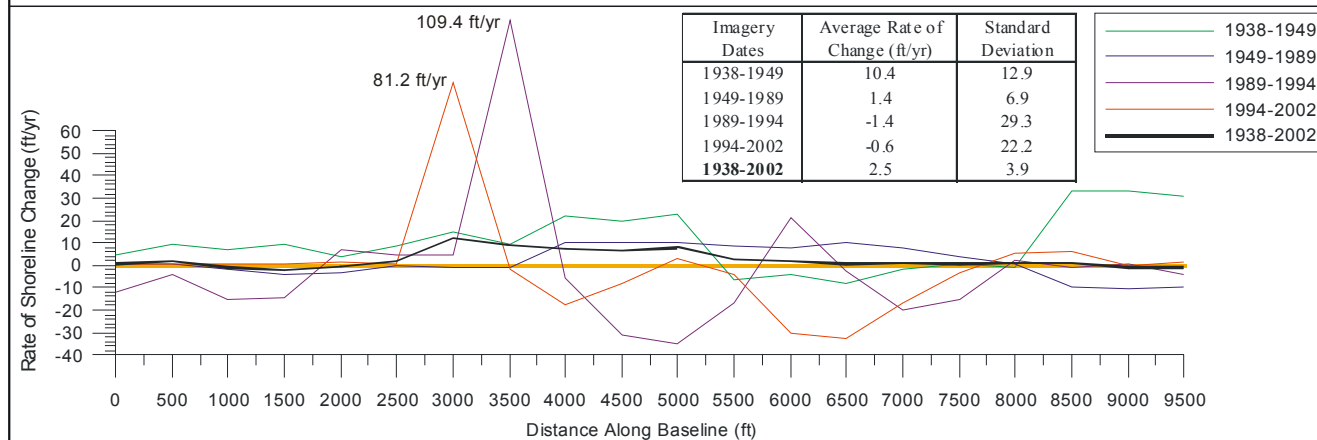
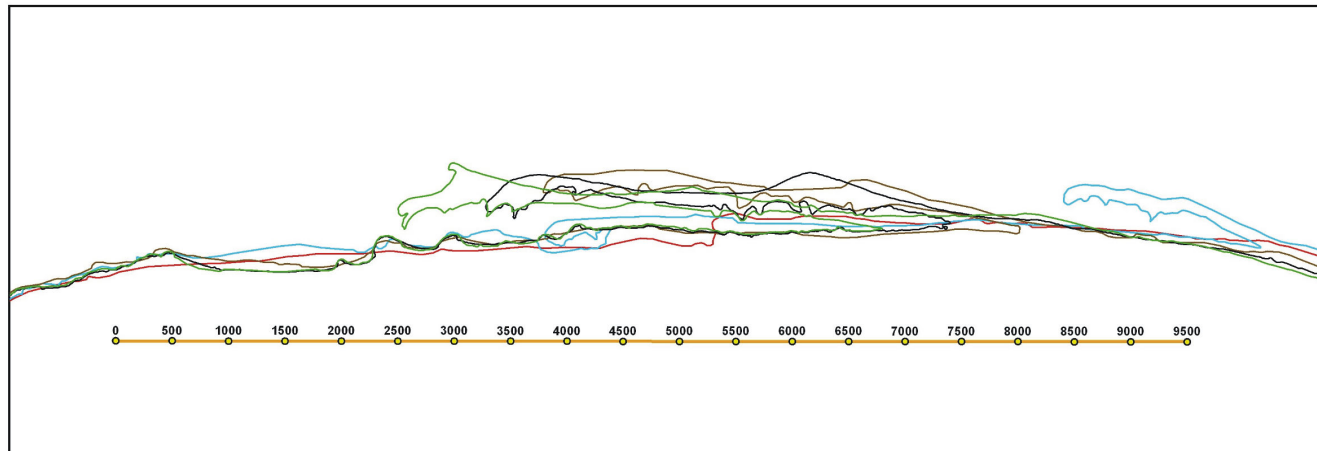
Plate 12 Morphologic Reach IV Church Neck

Legend

- Transect Points
- Baseline
- 2002 Shoreline
- 1994 Shoreline
- 1989 Shoreline
- 1949 Shoreline
- 1938 Shoreline



1,000 0 1,000 Feet



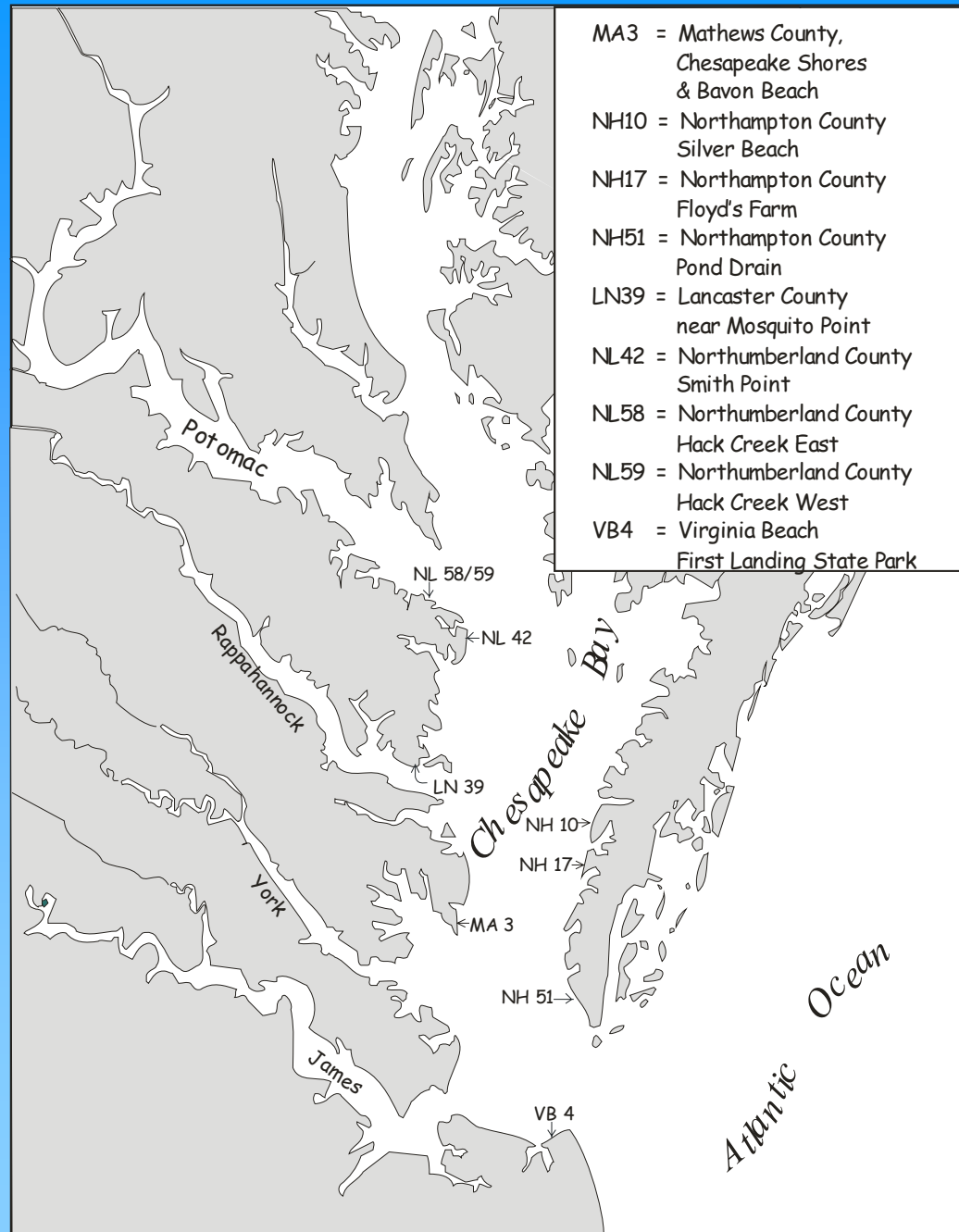
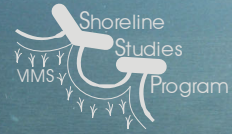


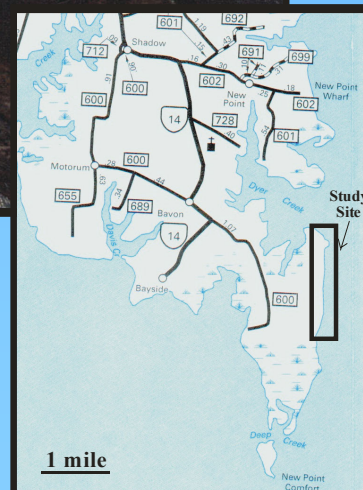
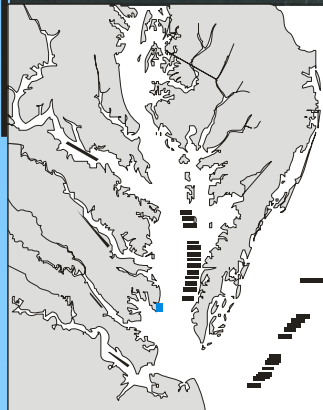
Photo Date 24 Oct 2001



MA3-8 →
MA3-7 →
MA3-6 →
MA3-5 →
MA3-4 →

MA3-3 →
MA3-2 →

MA3-1 →





MA3-8
Pre Isabel
27 March 2003



MA3-8
Post Isabel
2 October 2003



MA3-8
Recovery
14 July 2004

26 June 2003 - Pre Isabel



3 October 2003 - Post Isabel



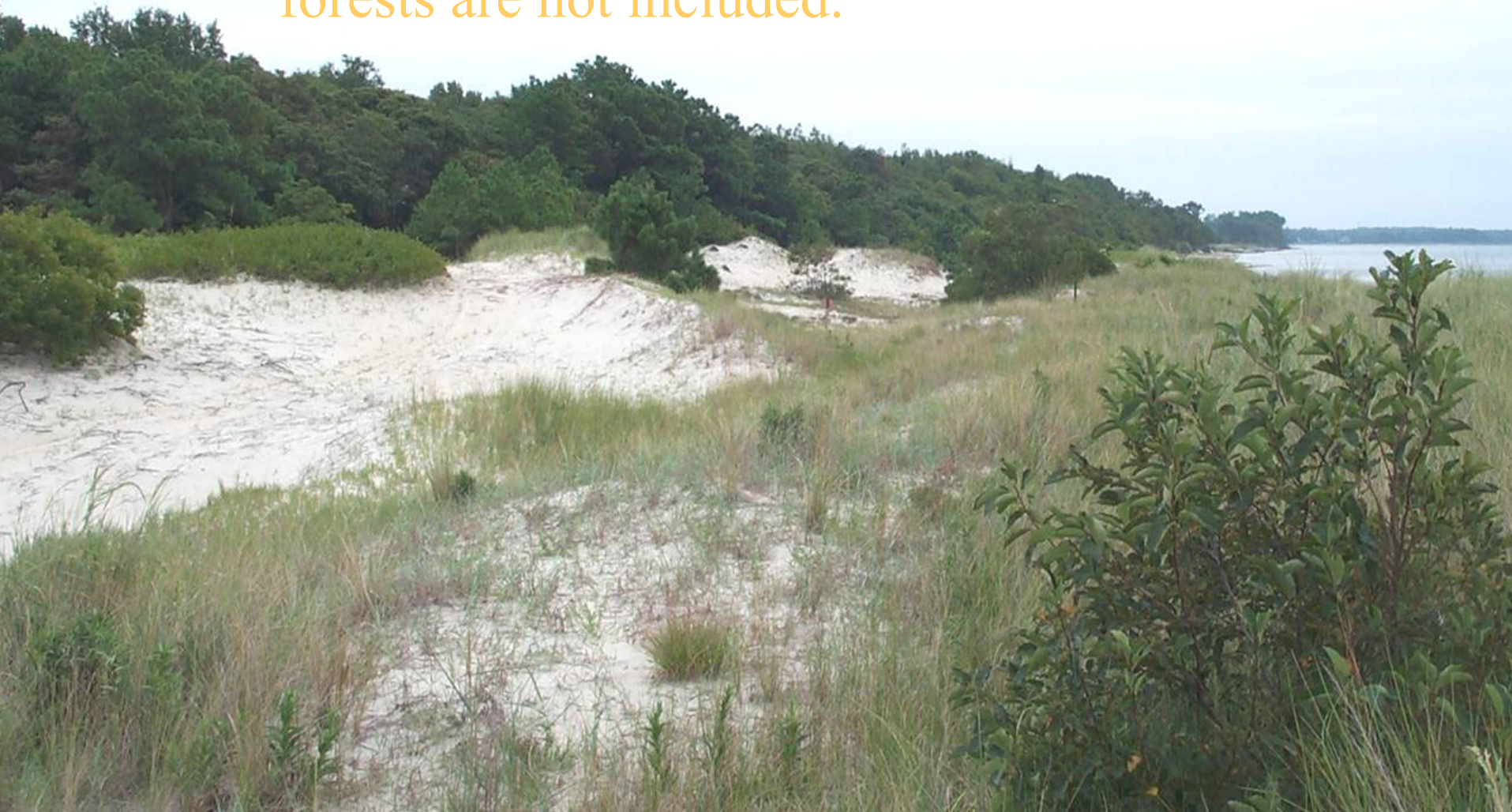
26 June 2003 - Pre Isabel

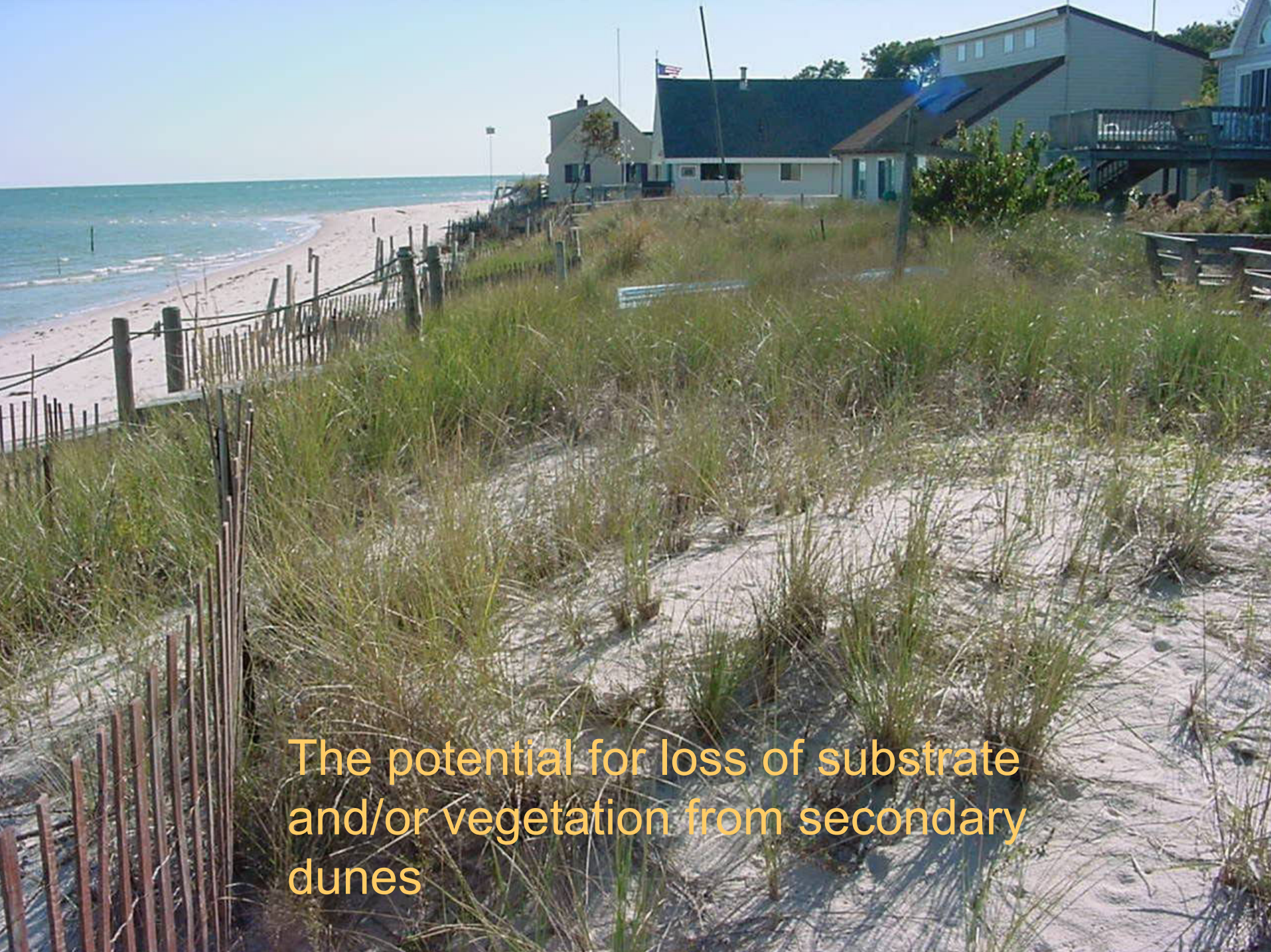


7 July 2004 - Recovery



The area of sandy substrate landward of the primary dune generally supporting dominant herbaceous and shrub communities. Maritime forests are not included.





The potential for loss of substrate
and/or vegetation from secondary
dunes



A Comparison of Virginia's Regulated Natural Resources

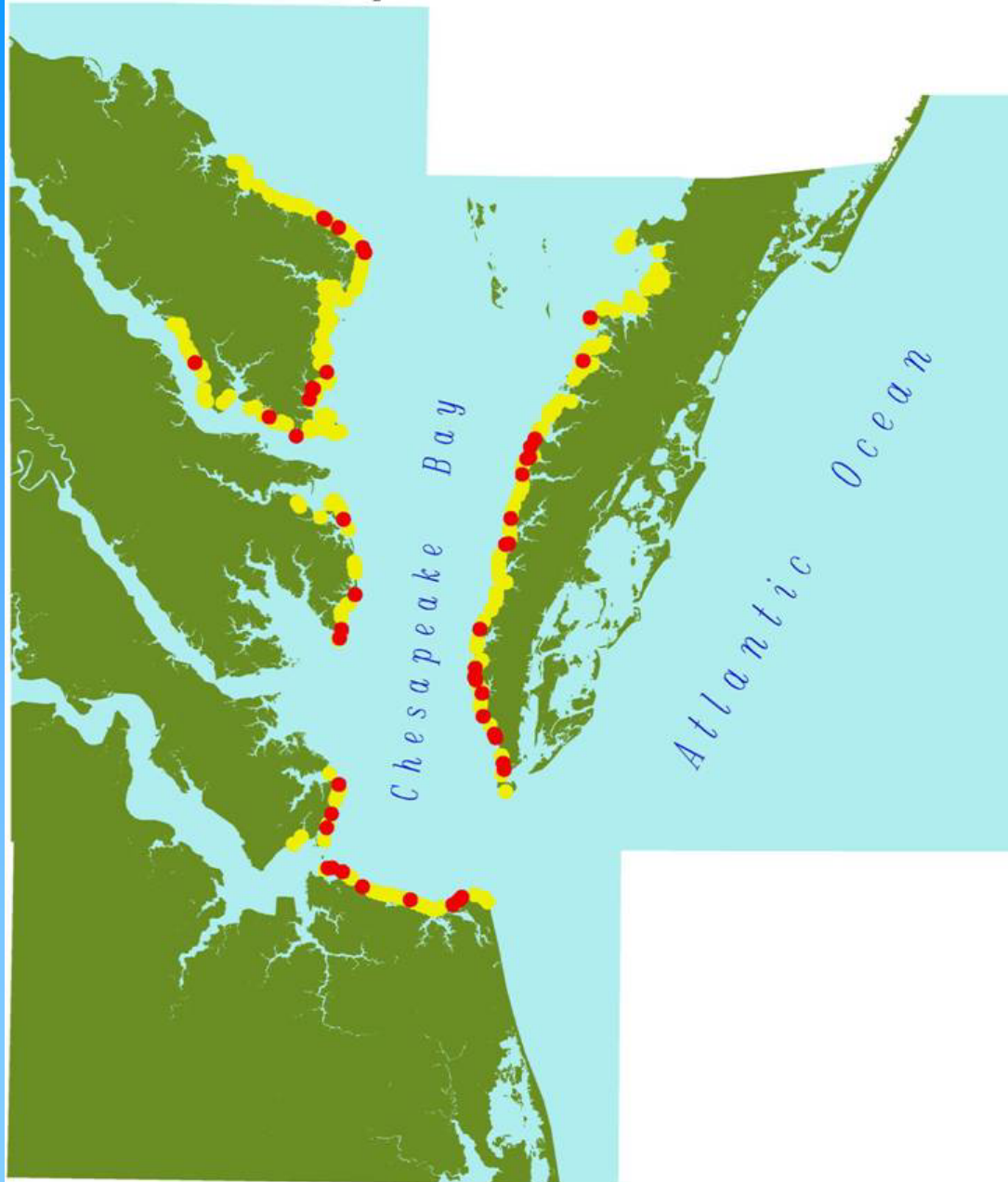
- Acres of Nontidal Wetlands: 1,075,000
- Acres of Tidal Wetlands: 190,000
- Acres of SAV: 30,000

Acres of Secondary Dunes: 310

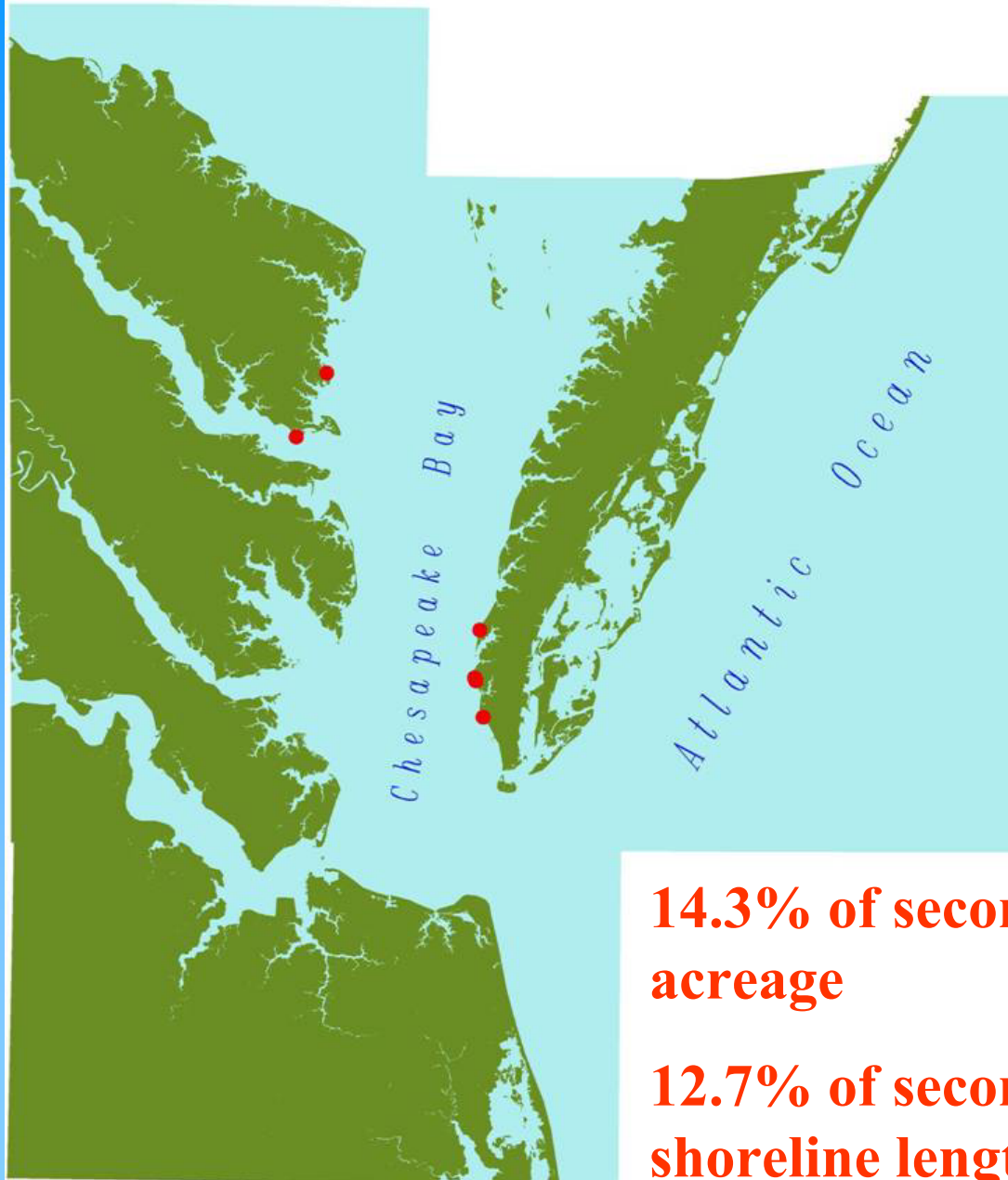
Risk Categories

- Protected: ownership, zoning, access, surrounding land use
- Impacted: minimal, moderate, significant
- Vulnerable: ownership, zoning, access, surrounding land use

Secondary Dunes



Valuable and At Risk



**14.3% of secondary dune
acreage**

**12.7% of secondary dune
shoreline length**

Land Control

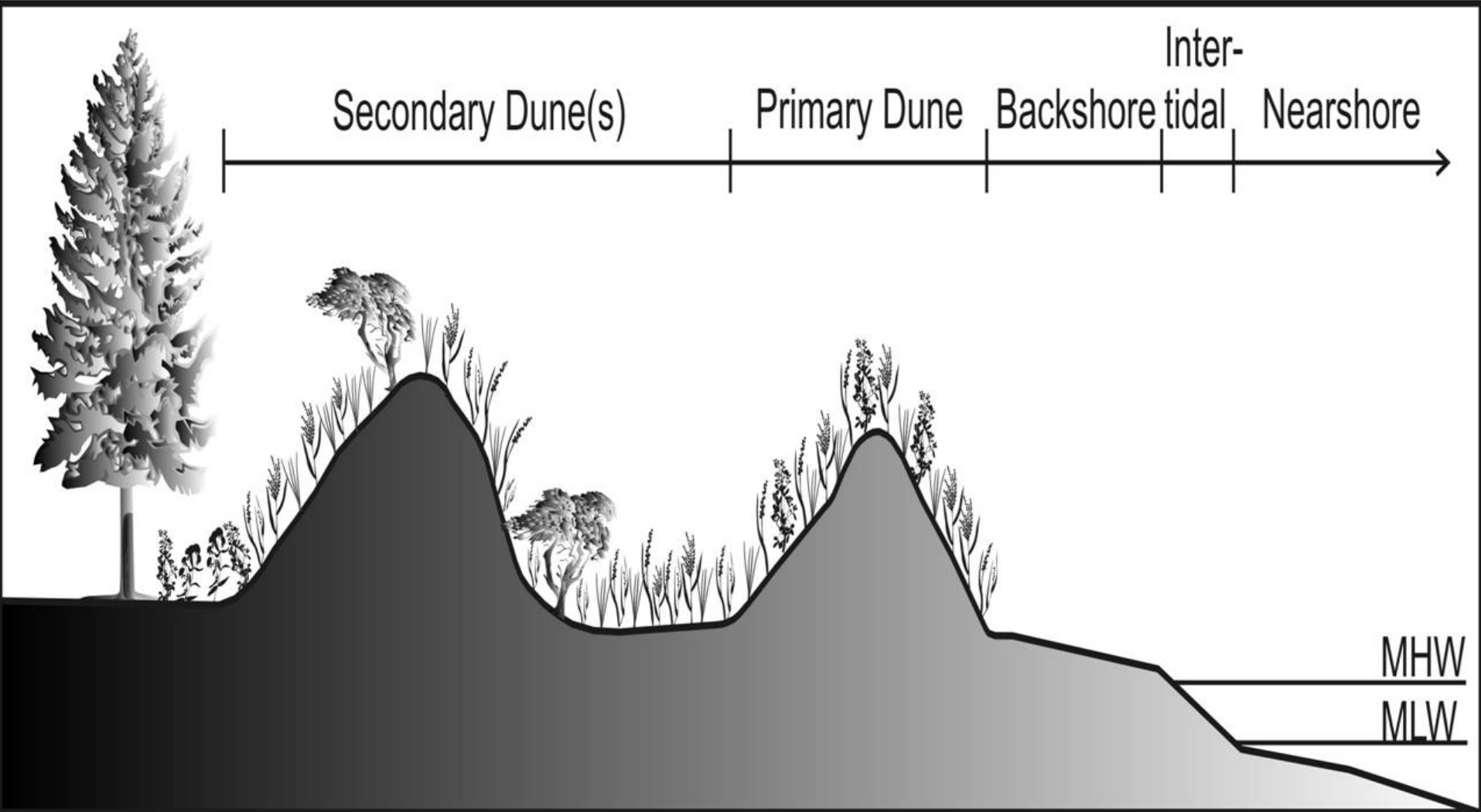


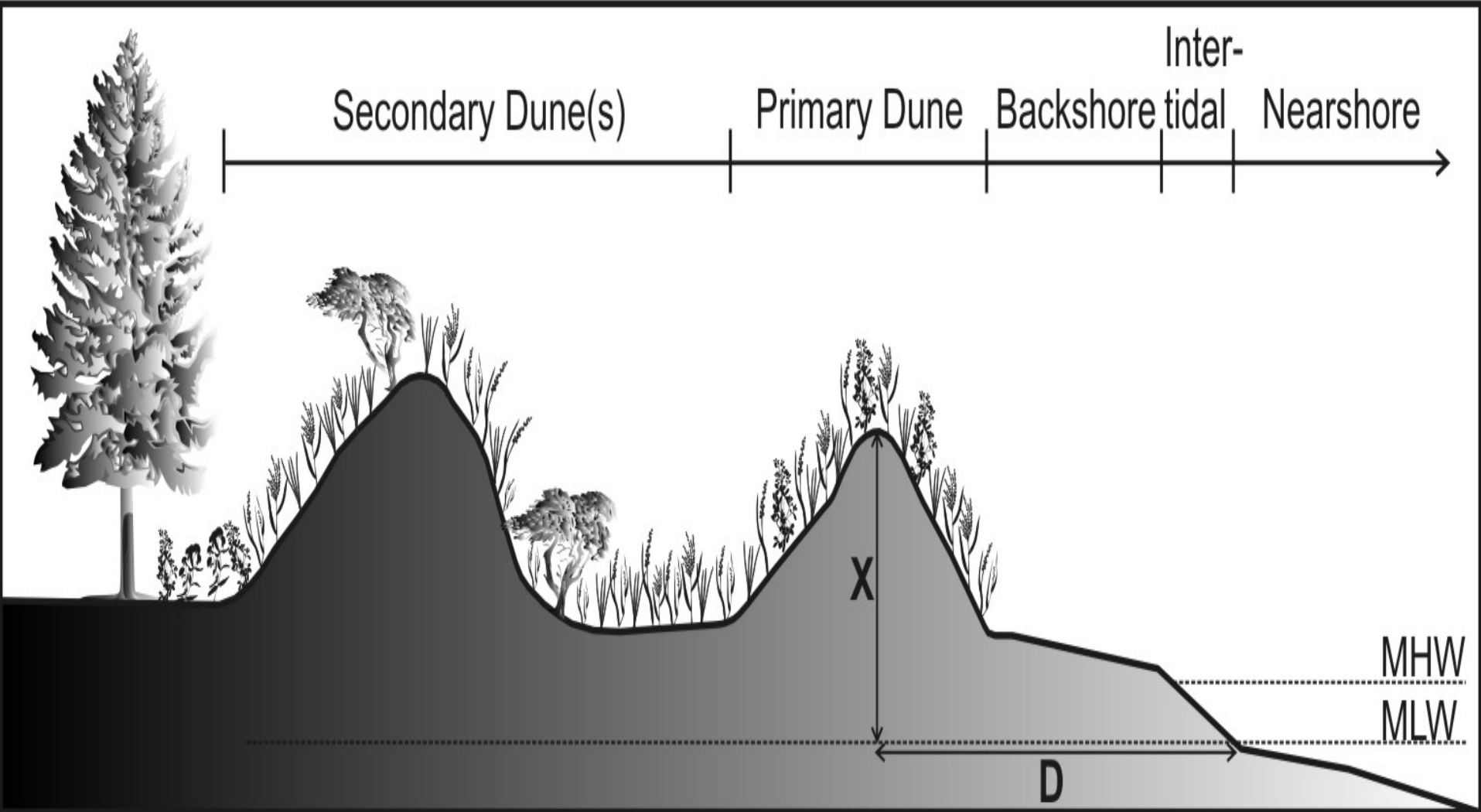
Path of least resistance?
Offers greatest amount of oversight
Conservation easements
Development rights
Land acquisition
Combinations

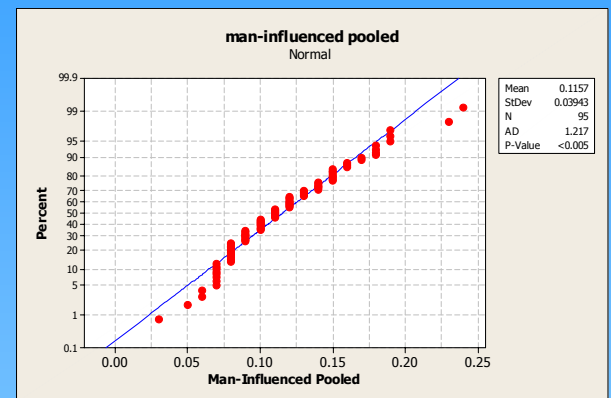
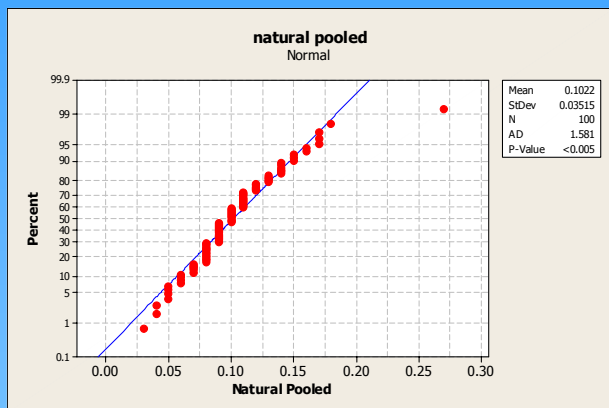
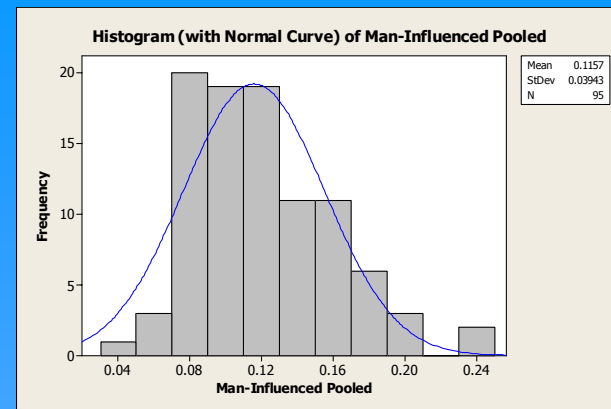
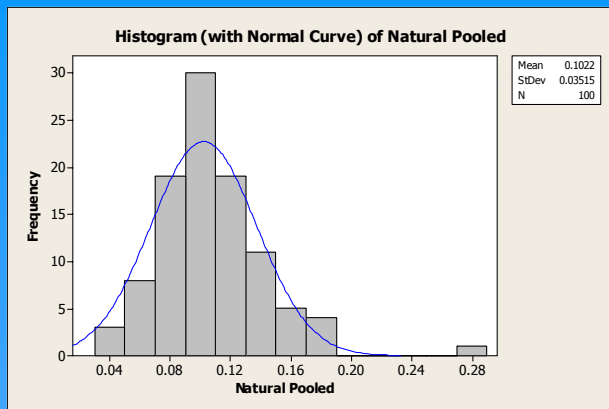


Picket's Har









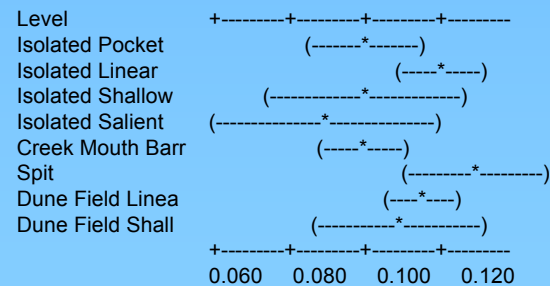
One-way ANOVA results:

Source	DF	SS	MS	F	P
Factor	7	0.01179	0.00168	1.21	0.298

S = 0.03726 R-Sq = 4.41% **R-Sq(adj) = 0.77%**

Level	N	Mean	StDev
Isolated Pocket	20	0.10050	0.02585
Isolated Linear	40	0.11775	0.04003
Isolated Shallow	7	0.09857	0.04598
Isolated Salient	5	0.09200	0.03633
Creek Mouth Barr	35	0.09971	0.03294
Spit	14	0.11571	0.05095
Dune Field Linea	62	0.11387	0.03756
Dune Field Shall	9	0.11000	0.02646

Individual 95% CIs For Mean Based on Pooled StDev



Pooled StDev = 0.03726

A few slides showing typical 10% dunes

7 Sep 2000



MA1

MA11

28 Aug 2000



MA8A

14 APR 1999



Dune growth is related to 3 components :

1) Stable Geomorphic Setting

2) Adequate Littoral Sand Supply

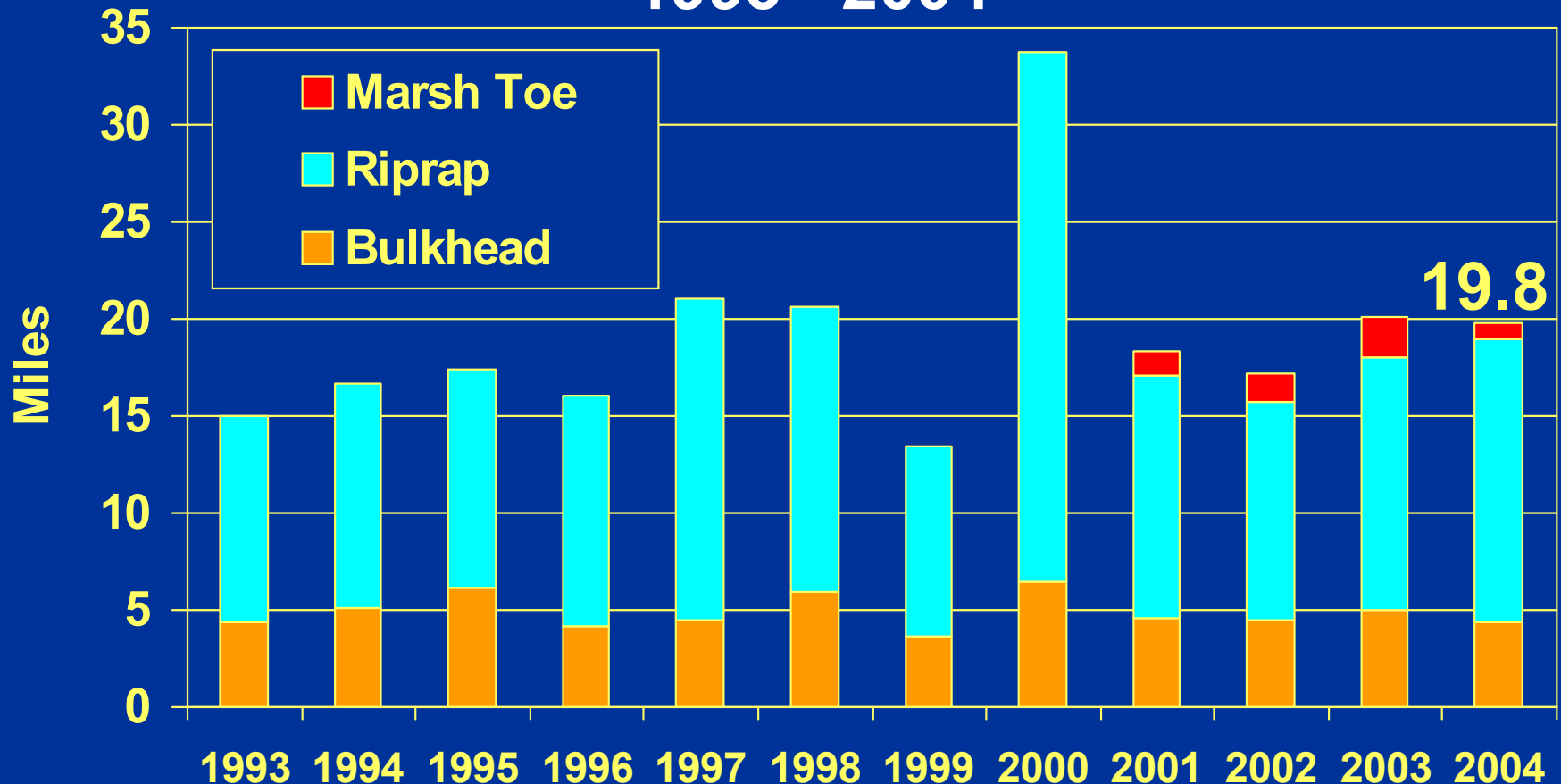
3) An onshore wind field capable of sand transport from broad beach/ Backshore to the dune face.

A photograph of a sandy beach littered with various seashells and debris. In the center, a small crab with a yellowish-brown body and translucent legs is positioned. A white speech bubble with a blue border points to the crab, containing the text "So What ?". The background is filled with numerous shells, including large, dark, elongated ones and smaller, lighter-colored ones, scattered across the sand.

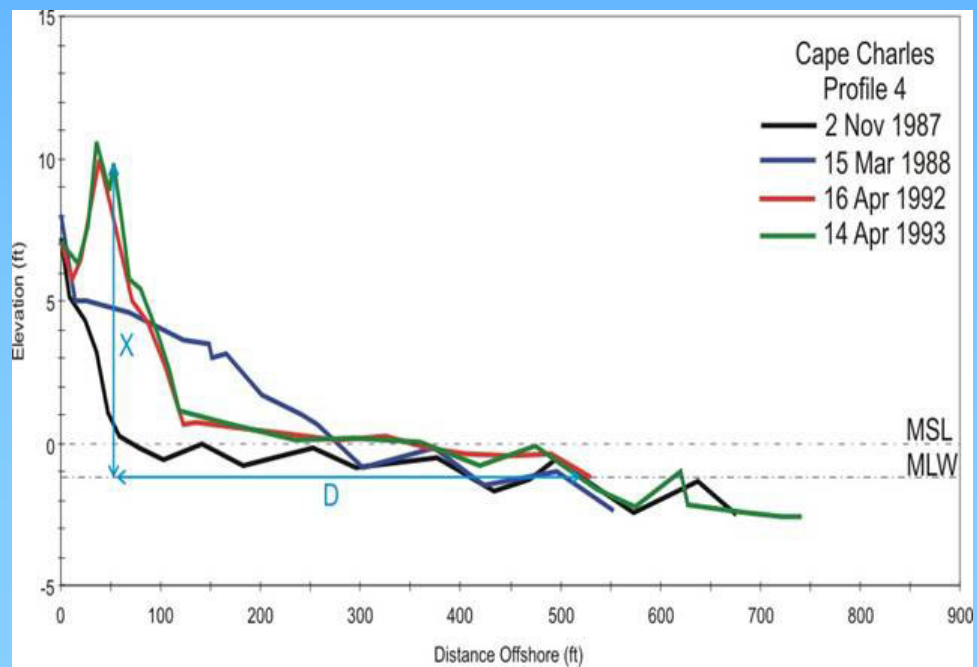
So What ?

PERMITTED MILES NEW SHORELINE STRUCTURES

1993 - 2004

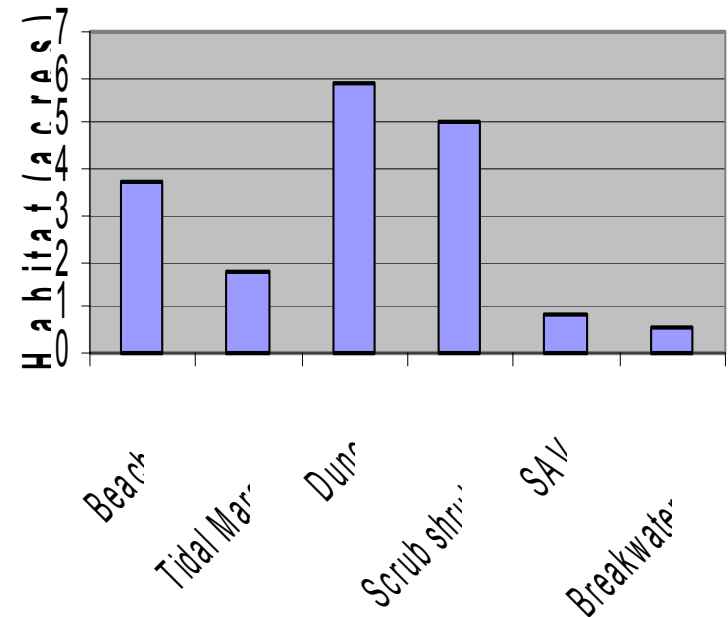
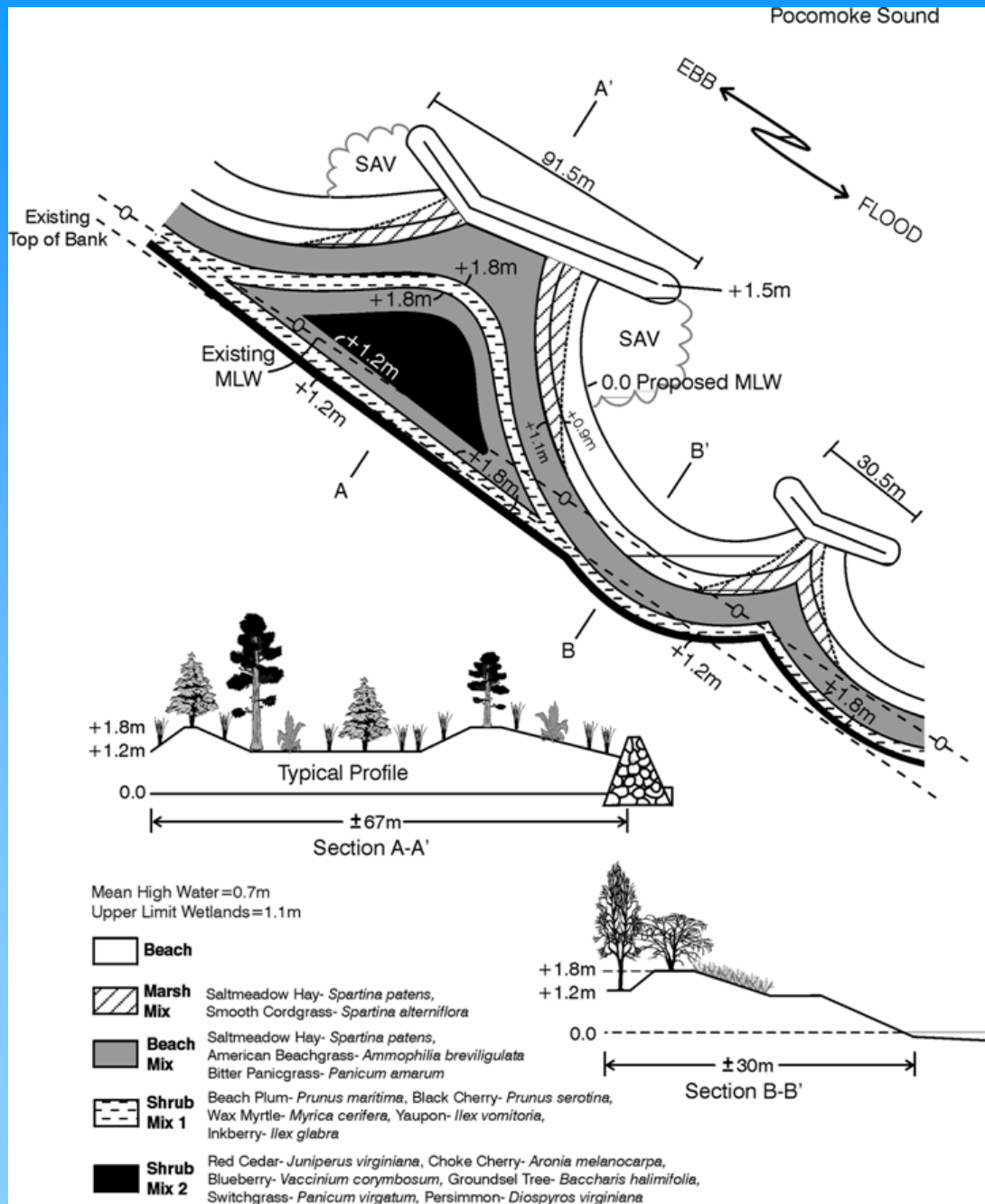


Total Miles New Shoreline Hardening (1993-2004)
229.2 miles





Saxis Manageme nt Plan Detail





We now have a robust design criteria that can aid managers in decisions concerning the fate of dredged material.



Dunes as a Management Strategy



The Dune Act



Jurisdictional Localities

- Accomack Co.
- City of Hampton
- Lancaster Co.
- Mathews Co.
- City of Norfolk
- Northampton Co.
- Northumberland Co.
- City of Virginia Beach

Non-Jurisdictional

Westmoreland, Middlesex, York, City of Newport News, Surry, Isle of Wight, Suffolk, Portsmouth

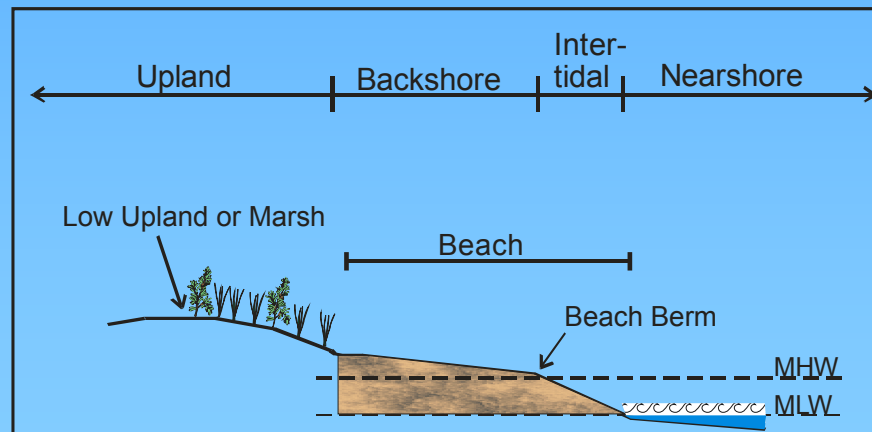
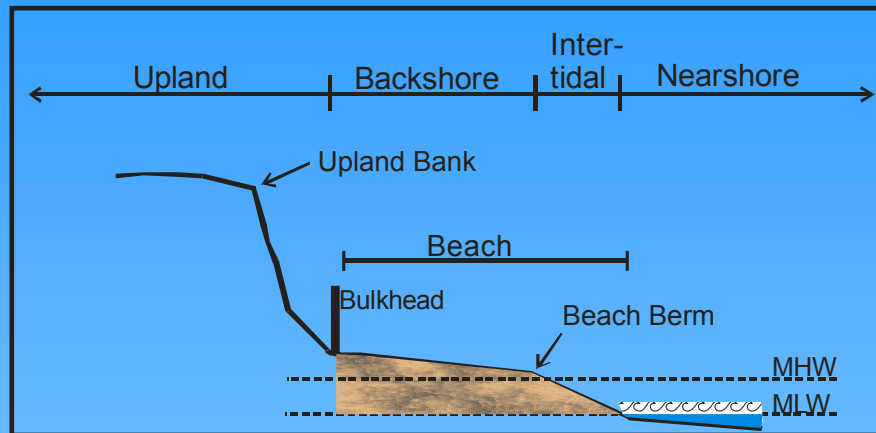


Figure 2. Typical cross-sections of beaches as defined by the Code of Virginia.

County Name	# Sites	Length			Width		
		Feet	Miles	Meters	<5 ft	5-10 ft	>10 ft
Charles City	29	3,146	0.6	959	13	14	2
Essex	55	8,153	1.5	2,485	18	23	14
Gloucester	235	45,968	8.7	14,011	67	117	51
Isle of Wight	77	52,959	10.0	16,142	39	30	8
James City	99	14,610	2.8	4,453	47	41	11
King and Queen	6	823	0.2	251	1	3	2
King George	91	45,745	8.7	13,943	27	50	14
Middlesex	216	53,560	10.1	16,325	36	86	94
New Kent	4	1,942	0.4	592	2	1	1
Newport News	45	11,709	2.2	3,569	13	13	19
Prince George	30	7,100	1.3	2,164	21	7	2
Richmond County	41	5,233	1.0	1,595	13	21	7
Stafford	45	17,152	3.3	5,228	14	22	9
Surry	157	54,925	10.4	16,741	95	51	11
Westmoreland	190	64,334	12.2	19,609	38	94	59
York	41	12,175	2.3	3,711	14	21	6
Total	1,361	399,534	75.7	121,778	458	594	310

		James River	York River	Rappahannock River	Potomac River	Total All Sites
	# Sites	437	286	312	326	1,361
Length	Feet	144,449	60,909	66,946	127,231	399,534
	Miles	27.4	11.6	12.7	24.1	75.7
	Meters	44,028	18,565	20,405	38,780	121,778
Width	<5 ft	228	84	67	79	458
	5-10 ft	156	142	130	166	594
	>10 ft	53	60	115	82	310
Tier	Man Influenced	148	158	238	239	783
	Manmade	81	16	7	3	107
	Natural	208	112	67	84	471
Landward Boundary	Erosional	156	71	49	83	359
	Stable	201	179	215	194	789
	Transitional	76	36	51	49	212
Geomorphic Setting	Creek Mouth Barrier/Spit	10	25	21	19	75
	Curvilinear	51	24	19	38	132
	Linear	236	177	238	227	878
	Pocket	66	15	15	5	101
	Salient	20	1	11	20	52
	Spit	5	1	2	7	15
	Tomboles	49	45	7	10	111
Stability	Accretionary	7	10	29	25	71
	Erosional	39	41	20	30	130
	Stable	392	235	263	271	1,161
Underlying Substrate	Marsh/ Creek Channel	76	104	64	70	314
	Upland	366	182	248	256	1,052



Isle of Wight
IWB37

Beach Length (ft)	837
Beach Width (ft)	<5 ft
Type	Man Influenced
Landward Boundary	Erosional
Landward Boundary Comments	High bank eroding, low concrete wall
Geomorphology	Linear
Stability	Stable
Underlying Substrate	Upland
Structure	Groin-Revetment/Bulkhead
Structure Comments	Groin downstream, revetment upstream

Figure 6. Isle of Wight site IWB37 2002 orthorectified aerial photo from VBMP, still shot from aerial video, and site attributes.



Newport News
NNB32

Beach Length (ft)	436
Beach Width (ft)	5-10 ft
Type	Marine
Landward Boundary	Transitional
Landward Boundary Comments	Cut marsh face
Geomorphology	Creek mouth barrier
Stability	Stable
Underlying Substrate	Marsh/Creek Bottom
Structure	Jetty-Revetment/Bulkhead Wall/Beach fill
Structure Comments	Creek jetty upstream boundary/Wood bulkhead downstream boundary

Figure 7. City of Newport News site NNB32 2002 orthorectified aerial photo from VBMP, still shot from aerial video, and site attributes.